## **Table of Contents**

## Chapter 1 – The Sampling Plan

- 1.1 Introduction
- 1.2 The Triad Approach
- 1.3 Site History Evaluating Existing Data/File Information
- 1.4 Defining the Physical Environment
- 1.5 Sample Locations and Numbers
- 1.6 Sample Methodology and Matrix
- 1.7 Laboratory Selection
- 1.8 Electronic Submission of Data for Site Remediation and Waste Management
  - 1.8.1 General Requirements
  - 1.8.2 Consistency in Data Fields Among Data Tables
  - 1.8.3 Securing Laboratory Services
  - 1.8.4 Geographically Referenced Points
  - 1.8.5 Permit Application and Compliance
- 1.9 Quality Assurance Considerations
- 1.10 Health and Safety Concerns
- 1.11 Schedule

References

**URLs** 

## **Chapter 2 – Quality Assurance**

#### 2.1 Introduction

- 2.1.1 Laboratory Certification
- 2.1.2 Analyze Immediately Environmental Laboratory Certification
- 2.1.3 Field and Laboratory Immunoassay Analysis Certification

#### 2.2 Data Quality Levels

- 2.2.1 Quality Assurance Programs
- 2.2.2 Field Analytical Methods

#### 2.3 Sample Containers

- 2.3.1 Reactivity of Container Material With Sample
- 2.3.2 Volume of the Container
- 2.3.3 Color of Container
- 2.3.4 Container Closures
- 2.3.5 Decontamination of Sample Containers
- 2.3.6 Chain of Custody
- 2.3.7 Sample Bottle Storage and Transport

### 2.4 Decontamination Procedures

- 2.4.1 Eight-Step Decontamination Procedure For Aqueous and Non-Aqueous Sampling Equipment Laboratory Only
- 2.4.2 Three-Step Equipment Decontamination Procedure Non-Aqueous Matrix Only Laboratory and Field
- 2.4.3 US Army Cold Regions Research and Engineering Laboratory Decontamination Procedures for Use Primarily on Water Sampling (or Ground-Water Sampling) Equipment Laboratory and/or Field Exclusively for Organics Including Pesticides

## Field Sampling Procedures Manual Table of Contents – Page 2 of 21

- 2.4.4 Ultra Clean Sampling Equipment Decontamination Laboratory or Field Table 2.1 Ultra Clean Supplies for Water Sampling Device Cleaning
- 2.4.5 General Decontamination Considerations
  - 2.4.5.1 Decontamination of Pumps
    - 2.4.5.1.1 Purging Only
    - 2.4.5.1.1.1 Submersible
    - 2.4.5.1.1.2 Surface Centrifugal and Diaphragm Pumps
    - 2.4.5.1.2 Sampling
    - 2.4.5.1.2.1 Submersible (Low Flow Purging and Sampling Method)
    - 2.4.5.1.2.2 Bladder Pumps
  - 2.4.5.2 Decontamination of Heavy Equipment
  - 2.4.5.3 Decontamination of Direct Push Equipment
  - 2.4.5.4 Decontamination of Monitor Well Casing and Screen
  - 2.4.5.5 Cleaning Location
  - 2.4.5.6 Disposal of Drill Cuttings
  - 2.4.5.7 Disposal of Installation, Development, Purge, Pump Test and Decontamination Waters

## 2.5 Procedures For Quality Assurance and Quality Control (QA/QC)

- 2.5.1 Non-Aqueous Matrix
  - 2.5.1.1 Field Blanks
    - 2.5.1.1.1 Description
    - 2.5.1.1.2 Frequency
  - 2.5.1.2 Trip Blanks
- 2.5.2 Aqueous Matrix
  - 2.5.2.1 Field Blanks
  - 2.5.2.2 Trip Blanks (Field Reagent Blanks)
    - 2.5.2.2.1 Description
    - 2.5.2.2.2 Frequency
- 2.5.3 Air Matrix
- 2.5.4 Blank Water Quality
- 2.5.5 Sample Handling and Holding Times
  - 2.5.5.1 Handling Time
  - 2.5.5.2 Maximum Holding Time
- 2.5.6 Special Analytical Services (SAS)
- 2.5.7 Additional QA/QC Samples
  - 2.5.7.1 Duplicate Samples Obtained in the Field (Field Duplicates)
    - 2.5.7.1.1 Aqueous Matrix Duplicates
    - 2.5.7.1.2 Non-Aqueous Matrix Duplicates
  - 2.5.7.2 Splitting Samples with Responsible Parties
  - 2.5.7.3 Background Samples

## 2.6 Sample Preservation Requirements

#### References

**URLs** 

#### **Appendix 2.1 Tables of Analytical Methods**

- Table 2.2 Required Preservation, Container, and Maximum Holding Times for Drinking Water Samples, Except Radiochemical Parameters
- Table 2.3 Required Preservation, Container, and Maximum Holding Times for Wastewater Samples and Solid/Hazardous Waste Samples (Aqueous Matrices), Except Radiochemical Parameters

- Table 2.4 Required Preservation, Container and Maximum Holding Times for Radiochemical Measurements in Drinking Water and Wastewater Samples
- Table 2.5 Required Preservation, Container and Maximum Holding Times for Radiochemical Measurements in Solid/Hazardous Waste Samples (Soils, Liquids, Sediments, and Sludges)
- Table 2.6 Required Preservation, Container and Maximum Holding Times for Solid/ Hazardous Waste Samples (Soils, Liquids, Sediments, Sludges, and Ambient Air)
- Table 2.7 Required Preservation, Container and Maximum Holding Times From VTSR for CERCLA-CLP Aqueous and Non-Aqueous Samples

#### **Footnotes**

Table 2.8 Analysis of BIOLOGICAL Samples Using NJDEP Methodologies for Freshwater, Estuarine and Marine Samples

## Chapter 3 – Gaining Entry to Inspect Sites For Actual or Suspected Pollution

- 3.1 General Rules and Exceptions
- 3.2 Procedure to be Followed to Gain Entry to a Site Where No Emergency Exists
  - 3.2.1 Initial approach
  - 3.2.2 If voluntary consent is initially refused
  - 3.2.3 If consent cannot be obtained by the DLPS and time is not of the essence
  - 3.2.4 If consent cannot be obtained in response to a letter, or if time is of the essence
- 3.3 Procedure to be Followed to Gain Entry to a Site When an Emergency Exists
- 3.4 Statutory Authority to Conduct Searches

## **Chapter 4 – Site Entry Activities**

#### 4.1 Introduction

#### 4.2 Health and Safety Program Plans

- 4.2.1 Organizational Structure
- 4.2.2 Hazard Analysis and/or Site Risk
- 4.2.3 Training Requirements for On-Site Personnel
- 4.2.4 Engineering Controls and Personnel Protection
- 4.2.5 Medical Surveillance Program
- 4.2.6 Air Monitoring
- 4.2.7 Site Control
- 4.2.8 Decontamination
- 4.2.9 Emergency Contingency Planning
- 4.2.10 Confined Space Operations
- 4.2.11 Other Special Operations

#### 4.3 General Safety Measures

- 4.3.1 Personal Practices
- 4.3.2 Operations Management

#### 4.4 Site Entry And Reconnaissance

- 4.4.1 Objectives
- 4.4.2 Preliminary Off-Site Evaluation
- 4.4.3 Preliminary On-Site Evaluation
  Table 4.1 Atmospheric Hazard Guidelines
- 4.4.4 Other Considerations

#### References

## **Chapter 5 – Sampling Equipment**

- 4	_			4 .
5.1		nti	$r \wedge \wedge$	tion
:). I			w	 

Table 5.1 Materials of Construction for Ground Water Sampling Equipment

### 5.2 Aqueous And Other Liquid Sampling Equipment

- 5.2.1 Ground Water Sampling Equipment
  - 5.2.1.1 Bottom Fill Bailer

Figure 5.1 Bottom fill bailer with Teflon® coated stainless leader

Figure 5.2 Teflon® constructed baler with Teflon® ball check valve

5.2.1.2 Peristaltic Pump

Figure 5.3 Geopump<sup>TM</sup> Peristaltic Pump

5.2.1.3 Bladder Pump

Figure 5.4 Example of a Teflon® constructed bladder pump

5.2.1.4 Variable Speed Submersible Centrifugal Pump

Figure 5.5 Grundfos® Pump

Figure 5.6 Grundfos® Pump being prepared for decontamination

5.2.1.5 Gear Pump

Figure 5.7 Fultz Pump

Figure 5.8 Gear Pump

5.2.1.6 Progressing Cavity Pump

Figure 5.9 Progressive Cavity Pump

5.2.1.7 Reciprocating Piston Pump

Figure 5.10 Reciprocating Piston Pump

Figure 5.11 Bennett Pump

5.2.1.8 Inertial Pump

Figure 5.12 Inertial Pump (Waterra)

Figure 5.13 Two styles of foot check valves offered by Geoprobe®

5.2.1.9 Syringe Sampler

Figure 5.14 Syringe Sampler

- 5.2.1.10 Suction-lift Pumps
- 5.2.1.11 Passive Diffusion Bag Samplers (PDBs)
  - 5.2.1.11.1 Deployed In Monitor Wells

Figure 5.15 Eon PDB Sampler with accessories

5.2.1.11.2 Deployed in Lake, Stream, River or Estuarine Sediment Figure 5.16 PDB for Sediments

- 5.2.1.12 Direct Push Technology
- 5.2.1.13 Packers
- 5.2.2 Wastewater Sampling Equipment
  - 5.2.2.1 Manual Sampling
  - 5.2.2.2 Automatic Sampling

Figure 5.17 ISCO® Sampler for single bottle collection

Figure 5.18 ISCO® Sampler for multiple bottle collection

- 5.2.3 Surface Water and Liquid Sampling Equipment
  - 5.2.3.1 Laboratory Cleaned Sample Bottle
  - 5.2.3.2 Pond Sampler

Figure 5.19 Pond Sampler

Figure 5.20 Fabricated Pond Sampler

5.2.3.3 Weighted Bottle Sampler

Figure 5.21 US WBH-96 Weighted Bottle Sampler

5.2.3.4	Wheaton Dip Sampler
	Figure 5.22 Wheaton Dip Sampler
5.2.3.5	Kemmerer Depth Sampler
	Figure 5.23 Kemmerer Depth Sampler
5.2.3.6	Van Dorn Sampler
	Figure 5.24 Van Dorn Sampler
5.2.3.7	Other Water Bottle Samplers
5.2.3.8	VOC Sampler
	Figure 5.25 VOC Sampler
5.2.3.9	Double Check Valve Bailer
	Figure 5.26 Double Check Valve Bailer
5.2.3.10	Bacon Bomb Sampler
	Figure 5.27 Bacon Bomb Sampler
5.2.3.11	Continuous Water-Quality Monitors
5.2.3.12	Churn Splitter
5.2.3.13	Sample Collection and Preservation Chamber
5.2.4 Conta	ninerized Liquid Sampling Equipment
	Coliwasa
	Figure 5.28 Coliwasa
5.2.4.2	Open Tube Thief Sampler
	Figure 5.29 Open Tube Thief Sampler
5.2.4.3	Stratified Thief Sampler
	Figure 5.30 Stratified Thief Sampler
3 Non-a	queous Sampling Equipment
	Sampling Equipment
5.3.1.2	^ <del>*</del> ^ ^
	Figure 5.31 Scoop/Trowel
5.3.1.2	Bucket Auger
	Figure 5.32 Bucket Auger
5.3.1.3	Soil Coring Device
	Figure 5.33 Soil Coring Device
5.3.1.4	Split Spoon Sampler
	Figure 5.34 Split Spoon Sampler
5.3.1.5	Shelby Tube Sampler
	En Core® Sampler
	Figure 5.35 En Core® Sampler with T Handle
5.3.1.7	Power Auger
5.3.1.8	
5.3.2 Sedin	nent and Sludge Sampling Equipment
	Benthic Grab Samplers
5.3.2.1	*
	Figure 5.36 Ponar Dredge
5.3.2.1	
	Figure 5.37 Ekman Grab Sampler
5.3.2.1	-
	Figure 5.38 Box Corer
5.3.2.1	_
	Figure 5.39 Shipek® Grab Sampler
5.3.2.1	1.5 Van Veen

5.3

## **Field Sampling Procedures Manual** Table of Contents - Page 6 of 21

	Figure 5.40 Van Veen Grab			
5.3.2.1	.6 Petersen Grab			
	Figure 5.41 Petersen Grab			
5.3.2.2	Sediment Core Samplers			
5.3.2.2	2.1 Hand Corer			
	Figure 5.42 Hand Corer			
5.3.2.2	2.2 Russian Peat Borer			
	Figure 5.43 Russian Peat Borer			
5.3.2.2	2.3 Split Core Sampler			
	Figure 5.44 Split Core Sampler			
5.3.2.2	2.4 Gravity Corer			
	Figure 5.45 Gravity Corers			
5.3.2.2	2.5 Vibracorer			
	Figure 5.46 Vibracorer			
5.3.2.2				
	Table 5.2 General Characteristics of Selected Grab and Core Samples			
5.3.2.3	$\mathcal{C}$ 1			
5.3.2.3	5.1 Lidded Sludge/Water Sampler			
	Figure 5.47 Lidded Sludge/Water Sampler			
5.3.2.3	5.2 Liquid Grab Sampler			
	Figure 5.48 Liquid Grab Sampler			
5.3.2.3	č i			
	Figure 5.49 Swing Jar Sampler			
5.3.2.3				
	Figure 5.50 Sludge Judge			
	inerized Solids and Waste Pile Sampling Equipment			
5.3.3.1	Grain Sampler			
	Figure 5.51 Grain Sampler			
5.3.3.2	Waste Pile Sampler			
	Figure 5.52 Waste Pile Sampler			
5.3.3.3	ampling Trier			
	gure 5.53 Sampling Trier			
	Table 5.3 Samplers Recommended for Various Types of Waste			
ferences				
GS Links	of Interest			

#### Refe

USG

**USEPA Links of Interest** 

Other URLs of Interest

**Appendix 5.1 – Sample Collection And Preservation Chamber** 

## **Chapter 6 – Sample Collection**

#### **General Information Applicable To All Sampling Events** 6.1

- 6.1.1 Preparation
- 6.1.2 Type of Samples
  - 6.1.2.1 Environmental and Waste Samples
  - 6.1.2.2 Grab vs. Composite
- 6.1.3 Laboratory Procurement
- 6.1.4 Quality Assurance Samples
- 6.1.5 Quality Assurance Project Plans

- 6.1.6 Assuring Health and Safety
- 6.1.7 Post Sampling Activities

### 6.2 Soil Sampling

- 6.2.1 Selection of Sampling Equipment
- 6.2.2 Equipment Preparation
- 6.2.3 Soil Logs
  - 6.2.3.1 Wentworth Scale

Table 6.1 Wentworth Scale as Modified from Driscoll, 1986, and Folk, 1975.

6.2.3.2 Unified Soil Classification System (USCS)

Table 6.2 Unified Soil Classification System; from American Society for Testing and Materials, 1985

Table 6.3. Unified Soil Classification System (USCS)

6.2.3.3 Burmister System

Table 6.4 Burmister Soil Classification Naming System (source: Dunn Geoscience Corporation)

Table 6.5 Burmister Soil Classification System Coarse-Grained Soils, Gradation of Components

Table 6.6 Burmister Soil Classification System Fine-Grained Soils, Plasticity of Components Table 6.7 Burmister Soil Classification System, Components and Fractions, Modified from Burmister. 1950

- 6.2.3.4 U.S. Comprehensive Soil Classification System Table 6.8 Textural Descriptions for USDA System
- 6.2.3.5 Comparison of the Soil Classification Systems
- 6.2.4 Field Log Books

Table 6.9 Comparison of the Soil Classification Systems compiled from various sources Boring Log

- 6.2.5 Determination of Soil Sample Location
  - 6.2.5.1 Surface Soil Selection
  - 6.2.5.2 Subsurface Soil Selection
- 6.2.6 Field Screening Soil Samples
- 6.2.7 VOCs Sample Collection for Soils
  - 6.2.7.1 VOC Soil Sample Depth Selection
  - 6.2.7.2 VOC Soil Sample Collection Devices Small Diameter Core Samplers
    - 6.2.7.2.1 Disposable Syringe
    - 6.2.7.2.2 Easy-Draw Syringe and Power-Stop Handle
    - 6.2.7.2.3 Purge and Trap Soil Sampler®
    - 6.2.7.2.4 En Core® Sampler
  - 6.2.7.3 VOC Soil Sample Collection Technique
  - 6.2.7.4 VOC Soil Sample Preservation Methods
    - 6.2.7.4.1 Closed-System Vials, No Chemical Preservation
    - 6.2.7.4.2 Closed-System Vials, No Chemical Preservation with Organic Free Water (OFW)
    - 6.2.7.4.3 Small Diameter Core Sampler for Storage and Transport (e.g., En Core® Sampler)
    - 6.2.7.4.4 Closed-System Vials, Chemical Preservation Sodium Bisulfate
    - 6.2.7.4.5 Closed-System Vials, Chemical Preservation Methanol
    - 6.2.7.4.6 Glass Containers, No Chemical Preservation, No Headspace
  - 6.2.7.5 Sample Aliquot for Moisture Determination and Sample Screening
  - 6.2.7.6 Commercial Equipment Suppliers

Table 6.10 Discrete Soil Sampler Suppliers

6.2.8 Non-VOC Sample Collection for Soils

## Field Sampling Procedures Manual Table of Contents – Page 8 of 21

- 6.2.9 Sampling Alternatives for Situational and Matrix Variations
  - 6.2.9.1 Sampling Hard or Cemented Material
  - 6.2.9.2 Sampling a Mixture of Fines and Gravel
  - 6.2.9.3 Sampling Dry Non-Cohesive Material
  - 6.2.9.4 Sampling Sediments
  - 6.2.9.5 Sampling Oil Waste, Tars and Other Waste Material
  - 6.2.9.6 Sampling from Test Pits

## 6.3 Rock Core Sample Collection

- 6.3.1 Coring Methods
  - 6.3.1.1 Drill String Coring
  - 6.3.1.2 Wireline Coring
- 6.3.2 Coring Tools
  - 6.3.2.1 Tube-Type Coring Tools
    - Figure 6.1 Double tube coring tool. Anderson, 1975, printed with permission.
    - Figure 6.2 Impregnated diamond bit. Acker, 1974, printed with permission.
  - 6.3.2.2 Sidewall Coring Tools
  - 6.3.2.3 Oriented Coring Tools
- 6.3.3 Coring Procedures
- 6.3.4 Rock Core Logging
- 6.3.5 Rock Core Storage
- 6.3.6 Special Tests and Analyses of Rock Cores
  - Table 6.11 Rock Coring Requirements

## 6.4 Direct Push Technology

### 6.5 Sampling Containerized Material

- 6.5.1 Drums, Bags, Sacks, Fiberdrums and Similar Small Containers
  - 6.5.1.1 Containerized Solids
  - 6.5.1.2 Containerized Liquids
- 6.5.2 Tanks, Vacuum Trucks, Process Vessels and Similar Large Containers
- 6.5.3 Transformers

#### 6.6 Waste Pile Sampling

- 6.6.1 Considerations for the Sampling Plan
  - 6.6.1.1 Shape and Size
  - 6.6.1.2 Characteristics of the Material
    - 6.6.1.2.1 Type of Material
    - 6.6.1.2.2 Chemical Stability
    - 6.6.1.2.3 Particle Size
    - 6.6.1.2.4 Compactness/Structure of Material
  - 6.6.1.3 Purpose of Sampling
- 6.6.2 Sampling Procedures
  - 6.6.2.1 Surface
  - 6.6.2.2 At Depth
- 6.6.3 Required Analytes and Frequency
  - 6.6.3.1 Waste Classification
  - 6.6.3.2 Quality Assurance
  - 6.6.3.3 Characterization

#### 6.7 Surficial Sampling

- 6.7.1 Wipe Samples
- 6.7.2 Chip Samples

- 6.7.3 Sweep Samples
- 6.7.4 Rinsate Samples

## 6.8 Surface Water And Sediment Sampling

- 6.8.1 General Considerations and Requirements for NJDEP Programs
  - 6.8.1.1 Health and Safety Considerations
  - 6.8.1.2 Physical Characteristics and Water Quality Measurements for Ambient Monitoring
  - 6.8.1.3 Sample Number and Location
  - 6.8.1.4 Sampling Sequence
  - 6.8.1.5 Surface Water Flow Conditions
  - 6.8.1.6 Tidal Influences
  - 6.8.1.7 Equipment Selection
    - 6.8.1.7.1 Aqueous
    - 6.8.1.7.2 Non-Aqueous
  - 6.8.1.8 Considerations for Wastewater Point Source Sampling
- 6.8.2 Freshwater and Biological Monitoring Program
  - 6.8.2.1 Sampling Objectives
  - 6.8.2.2 Aqueous Samples
    - 6.8.2.2.1 Stream/Flowing Water
    - 6.8.2.2.2 Composite Sampling
    - 6.8.2.2.3 Grab Sampling
    - 6.8.2.2.4 Point Sampling
    - 6.8.2.2.5 Lake/Standing Water Sampling
    - 6.8.2.2.6 Estuarine and Marine Water Sampling
    - 6.8.2.2.7 Bacteriology
    - 6.8.2.2.8 Trace Element Sampling
  - 6.8.2.3 Non-Aqueous Samples
    - 6.8.2.3.1 Sediments
      - 6.8.2.3.1.1 Onshore
      - 6.8.2.3.1.2 Offshore
    - 6.8.2.3.1.3 General Procedures
    - 6.8.2.3.2 Sludge
  - 6.8.2.4 Flow Measurements
    - 6.8.2.4.1 Open-Channel Flow Measurement
    - 6.8.2.4.2 Open-Channel Flow Meters
      - 6.8.2.4.2.1 Palmer-Bowlus Flumes
      - 6.8.2.4.2.2 Parshall Flumes
    - 6.8.2.4.3 Weirs
      - 6.8.2.4.3.1 V-Notch Weirs
      - 6.8.2.4.3.2 Rectangular Weirs
      - 6.8.2.4.3.3 H-Type Flumes
    - 6.8.2.4.4 Instrumentation for Open-Channel Flow
    - 6.8.2.4.5 Closed-Pipe Flow Metering Systems
    - 6.8.2.4.6 Types of Meters, Methods and Systems
      - 6.8.2.4.6.1 Electromagnetic Flow Meters
      - 6.8.2.4.6.2 Turbine Meters and Propeller Meters
      - 6.8.2.4.6.3 Rotating Element Current Meters
        - Figure 6.3 Propeller Current Meter
        - Figure 6.4 Price Current Meter
      - 6.8.2.4.6.4 Ultrasonic Meters

# Field Sampling Procedures Manual Table of Contents – Page 10 of 21

6.9

6.8.2.4.6.5 Pitot Tube Meters
6.8.2.4.6.6 Differential Pressure Systems
6.8.2.4.6.7 Velocity Modified Flow Meters
6.8.2.4.6.8 Floats
6.8.2.4.6.9 Salt Velocity Method
6.8.2.4.6.10 Color Velocity Method
6.8.2.4.6.11 Discharge
6.8.2.4.7 Miscellaneous Flow Measurement Methods
6.8.2.4.7.1 Water Meters
6.8.2.4.7.2 Measure Level Changes in Tank
Figure 6.5 Stationary Volume of Liquid in Horizontal Cylinders
6.8.3 Site Remediation and Waste Management Program
6.8.3.1 Sampling Objectives
Table 6.12 Comparison of Various Methods to Obtain Mean Velocity
6.8.3.1.1 Site-Related Sample Locations
6.8.3.1.2 Reference Sample Location
6.8.3.2 Aqueous Samples
6.8.3.2.1 Flowing Non-Tidal Water Bodies
6.8.3.2.2 Standing Water Bodies
6.8.3.2.3 Tidal Water Bodies
6.8.3.2.4 Determination of Contaminated Ground Water Discharge Points
6.8.3.3 Non-Aqueous Samples
6.8.3.3.1 General
6.8.3.3.2 Flowing Non-Tidal Water Bodies
6.8.3.3.3 Standing Water Bodies
6.8.3.3.4 Tidal Water Bodies
6.8.3.4 Use of Passive Diffusion Bag Samplers
Ground Water Sampling Procedures
6.9.1 Scope
6.9.2 Means of Sample Collection
6.9.2.1 Temporary Well Points and Direct Push Technology
6.9.2.2 Low-Flow Purging and Sampling
6.9.2.2.1 Method Summary and Application
6.9.2.2.2 Introduction
Low Flow Sampling Data Sheet
Field Instrumentation and Calibration Data Sheet
Monitor Well Information in Support of Pump Intake Depth Placement
6.9.2.2.3 Low Flow Policy
6.9.2.2.4 Laboratory Certification (N.J.A.C. 7:18)
6.9.2.2.5 Specific LFPS Considerations
6.9.2.2.5.1 Pump Intake Location
6.9.2.2.5.2 Water Quality Indicator Parameters (WQIPs)
6.9.2.2.5.3 Purge Volume vs. Stabilization Time
6.9.2.2.5.4 Tubing
6.9.2.2.5.5 Flow-Through Cell
Figure 6.6 Illustration of Flow Cell with stand
6.9.2.2.5.6 Pump Selection
6.9.2.2.5.7 Plumbing Fittings
Figure 6.7 Closeup of Needle Valve

```
6.9.2.2.5.8 Calibration of Probes
      6.9.2.2.5.9 Water Level Measurements
      6.9.2.2.5.10 Pump Installation
      6.9.2.2.5.11 Purge Rates
      6.9.2.2.5.12 Sampling
      6.9.2.2.5.13 Pump Decontamination
                   Figure 6.8 Grundfos® Pump being prepared for decontamination
      6.9.2.2.5.14 Field Blank Collection
     6.9.2.2.6 Tips
      6.9.2.2.6.1 Temperature Measurement and Submersible Pumps
      6.9.2.2.6.2 Control of Pump Speed
      6.9.2.2.6.3 pH
      6.9.2.2.6.4 Temperature of Calibration Solutions
   6.9.2.3 Low-flow Purging and Sampling for Low-Yielding Wells
           Volume-Averaged Purging and Sample Collection
   6.9.2.4
   6.9.2.5 Point Source (No-Purge) Sampling
     6.9.2.5.1 Passive Diffusion Bag Samplers (PDBS)
      6.9.2.5.1.1 Introduction
      6.9.2.5.1.2 Limitations And Concerns
      6.9.2.5.1.3 Theory
      6.9.2.5.1.4 PDBS Construction
      6.9.2.5.1.5 Contaminant Detection Capabilities
                 Table 6-13 Passive Diffusion Bag Samplers (PDBS)
      6.9.2.5.1.6 Well Construction Considerations
      6.9.2.5.1.7 Contaminant Stratification/Multiple Sampler Deployment
      6.9.2.5.1.8 Vertical Flow Within the Well
      6.9.2.5.1.9 Comparison of PDBS Results with Conventional Sampling Methods
      6.9.2.5.1.10 Use of PDBS in Sentinel Wells
      6.9.2.5.1.11 Procedures for PDBS Use (Deployment/Retrieval)
         6.9.2.5.1.11.1 Weights and Deployment Lines
         6.9.2.5.1.11.2 Measuring and Attaching the PDBS to the Deployment Line
         6.9.2.5.1.11.3 Equilibration Time
         6.9.2.5.1.11.4 Sample Retrieval
         6.9.2.5.1.11.5 Quality Assurance/Quality Control Samples
         6.9.2.5.1.11.5.1 Blanks for Lab filled PDBS
         6.9.2.5.1.11.5.2 Blanks for Field Filled PDBS
      6.9.2.5.1.12 Data Reporting Requirements
                   NJDEP Checklist for the Submission of Sampling Data for Passive Diffusion
                   Bag Samplers (PDBS)
            Sampling Private Homeowner Wells (a.k.a. Public Non-Community/Non-Public/Domestic Wells)
6.9.4 Sampling Point of Entry Treatment (POET) Systems
6.9.5 Sampling Industrial Wells
6.9.6 Sampling Municipal and Industrial Wastewater
      Table 6.14 Suggested Biochemical Oxygen Demand Dilutions
6.9.7 Public Community Water Systems
   6.9.7.1 Source Sample (Raw water)
     6.9.7.1.1 Ground Water
     6.9.7.1.2 Surface Water
```

6.9.7.2 Plant Delivered Sample (Finished Water)

## Field Sampling Procedures Manual Table of Contents – Page 12 of 21

- 6.9.7.3 Point of Entry Sample 6.9.7.4 System Sample 6.9.8 Ground Water-Level Measurements 6.9.8.1 Steel Tapes 6.9.8.2 Electronic Ground Water-Level Indicators 6.9.8.3 Helpful Hints 6.9.8.4 Ground Water Level and Non-Aqueous Phase Liquid (NAPL) Measurements 6.9.8.4.1 Clear Bailer 6.9.8.4.2 Interface Probes 6.9.9 New Well Construction and Stabilization 6.9.9.1 Well Development Figure 6.9 Sand Bridges 6.9.9.2 Other Considerations 6.9.10 Filtering Ground Water Samples 6.9.10.1 Total Metals Sampling 6.9.10.2 Trace Metals Sampling 6.9.10.3 Dissolved Metals Sampling 6.9.10.4 Filtering Procedures for Dissolved Metals Analysis 6.9.11 Sampling for Light, Non-Aqueous Phase Liquids (LNAPLS) 6.9.12 Sampling for Dense, Non-Aqueous Phase Liquids (DNAPLs) 6.10 Biological Sampling Procedures 6.10.1 Phytoplankton Sampling 6.10.1.1 Sample Site Location 6.10.1.2 Sampling Depth 6.10.1.3 Sampling Procedure 6.10.2 Zooplankton Sampling 6.10.2.1 Sample Site Location 6.10.2.2 Sample Depth 6.10.2.3 Sampling Procedure 6.10.3 Macrophyte Sampling 6.10.4 Macroinvertebrates 6.10.4.1 Hester-Dendy Artificial Substrates 6.10.4.1.1 Sampler Placement 6.10.4.1.2 Sampler Retrieval 6.10.4.2 Surber or Square Foot Bottom Sampler 6.10.4.2.1 Sampler Placement 6.10.4.2.2 Sampler Retrieval 6.10.5 Grab Samplers 6.10.6 Periphyton Sampling 6.10.6.1 Artificial Substrates 6.10.6.1.1 Sampler Placement 6.10.6.1.2 Sampler Retrieval 6.10.6.2 Natural Substrates 6.10.7 Rapid Bioassessment (RBP) Techniques\*
  - 6.10.7.3 Multi-habitat Sampling 6.10.7.4 Periphyton

6.10.7.1 Benthic Macroinvertebrates6.10.7.2 Single Habitat Sampling

#### 6.11 **Toxicological Sampling (Toxicity Test or Bioassay)** 6.11.1 Dilution Water Sample Collection and Handling: 6.11.2 Effluent Samples Shall be Collected and Handled in the Following Manner. Appendix 6.1 Monitor Well Construction and Installation A.6.1.1 Introduction A.6.1.2 Conventional Well Drilling Methods Hollow-Stem Augers (HSAs) A.6.1.2.1 A.6.1.2.2 Rotary Drilling A.6.1.2.3 **Drilling Fluids** A.6.1.3 Specialized Drilling Methods A.6.1.3.1 Sonic Drilling A.6.1.3.2 ODEX® Method Figure 6.10 ODEX® System A.6.1.3.3 Direct-Push Drilling A.6.1.4 Monitor Well Design And Construction Considerations A.6.1.4.1 Well Diameter A.6.1.4.2 Well Construction Materials A.6.1.4.3 Screen Length Screen Slot Size and Filter Pack Materials A.6.1.4.4 A.6.1.4.5 **Grouting Materials** Well Depth A.6.1.4.6 A.6.1.4.7 Multi-Screened Wells A.6.1.4.8 Pre-Packed Well Screens A.6.1.4.9 Horizontal Wells A.6.1.4.10 Wells Used to Investigate LNAPL and DNAPL A.6.1.4.11 Lysimeters A.6.1.5 Miscellaneous Well Construction Considerations A.6.1.5.1 Well Development Maintenance of Wells A.6.1.5.2 A.6.1.5.3 Well Decommissioning Requirements Flush Mount Wells A.6.1.5.4 Figure 6.11 Typical Flush-Mount Completion Subsurface and Overhead Utilities A.6.1.5.5 Appendix 6.2 NJDEP Monitor Well Specifications for Bedrock, Unconsolidated and Confined Aquifers A.6.2.1Monitoring Well Requirements For Bedrock Formation Figure 6.12 Bedrock Formation Well A.6.2.2 Monitor Well Requirements For Unconsolidated Aquifers Figure 6.13 Unconsolidated Aquifer Well A.6.2.3 Monitor Well Requirements For Confined Unconsolidated Aquifers Figure 6.14 Confined Unconsolidated Aquifer Well References **USGS Links of Interest USEPA Links of Interest**

Other URLs of Interest

Soil Science

**Soil Classification** 

**Sediments** 

Manufacturers/Vendors of Environmental Sampling Equipment

General

## **Chapter 7 – Field Analysis**

- 7.1 Introduction
- 7.2 Application of Field Analytical Methods
- 7.3 Field Analytical Techniques
- 7.4 Specific Advantages of Field Analysis
- 7.5 Selection of a Field Analysis Method
- 7.6 Factors To Be Considered For Field Analyses
- 7.7 Role of Field Screening/Analytical Methods According to the NJDEP Technical Requirements For Site Remediation, N.J.A.C. 7:26E
- 7.8 Regulatory Initiative For Development of Field Analyses
- 7.9 Choosing Appropriate Field Analytical Methods For Contaminant Investigation
  - 7.9.1 Considerations Prior To Researching Field Analytical Methods
    - 7.9.1.1 Matrix Effects
    - 7.9.1.2 Analyte(s) of Concern
    - 7.9.1.3 Interfering Constituents
    - 7.9.1.4 Limitations
    - 7.9.1.5 Physical Conditions
  - 7.9.2 Searching the Websites
    - 7.9.2.1 FATE
    - 7.9.2.2 EPAREACHIT
    - 7.9.2.3 FRTR
    - 7.9.2.4 CLU-IN
  - 7.9.3 Listing Limitations and Interferences for Selected Field Analytical Methods
    - 7.9.3.1 Matrix Effectsm
    - 7.9.3.2 Analytes
    - 7.9.3.3 Interfering Constituents
    - 7.9.3.4 Limitations
    - 7.9.3.5 Physical Conditions
- 7.10 Quality Assurance Project Plan (QAPP) For Implementation of Field Analytical Methods

## 7.11 Quality Assurance Requirements

- 7.11.1 Preliminary or Field Screening Data (Data Quality Level 1)
- 7.11.2 Effective Data or Field Analysis Data (Data Quality Level 2)
- 7.11.3 Meticulous or Definitive Data (Data Quality Level 3)
- 7.11.4 "State-of-the-Art" Data

#### 7.12 Field Data Deliverables Format

- 7.12.1 Field-Screening Data QA/QC Requirements
- 7.12.2 Effective Data or Field Analysis Data QA/QC Requirements
  - Table 7.1 Overview of Data Quality Classifications

## 7.13 Data Management Plan

References/Resources

**Glossary** 

## **Chapter 8 – Geophysical Techniques**

#### 8.1 Introduction

### 8.2 Ground Penetrating Radar

- 8.2.1 Fundamentals
- 8.2.2 Advantages
- 8.2.3 Limitations
- 8.2.4 Instrumentation
- 8.2.5 Survey Design, Procedure and Quality Assurance
- 8.2.6 Data Reduction and Interpretation
- 8.2.7 Presentation of Results

#### 8.3 Magnetics

- 8.3.1 Fundamentals
- 8.3.2 Advantages
- 8.3.3 Limitations
- 8.3.4 Instrumentation
- 8.3.5 Survey Design, Procedure and Quality Assurance
- 8.3.6 Data Reduction and Interpretation
- 8.3.7 Presentation of Results

## 8.4 Gravity

- 8.4.1 Fundamentals
- 8.4.2 Advantages
- 8.4.3 Limitations
- 8.4.4 Survey Design, Procedure and Quality Assurance
- 8.4.5 Data Reduction and Interpretation
- 8.4.6 Presentation of Results

#### 8.5 Electrical Resistivity

- 8.5.1 Fundamentals
- 8.5.2 Advantages
- 8.5.3 Limitations
- 8.5.4 Instrumentation
- 8.5.5 Survey Design, Procedure and Quality Assurance
- 8.5.6 Sounding Mode
- 8.5.7 Profiling Mode

Figure 8.1 Common Arrays

- 8.5.8 Profiling-Sounding Mode
- 8.5.9 Resistivity Data Reduction and Interpretation
- 8.5.10 Presentation of Results
  - 8.5.10.1 Sounding Mode
  - 8.5.10.2 Profiling Mode
  - 8.5.10.3 Profiling-Sounding Mode

#### 8.6 Induced Polarization

- 8.6.1 Fundamentals
- 8.6.2 Advantages
- 8.6.3 Limitations
- 8.6.4 Instrumentation
- 8.6.5 Survey Design, Procedure and Quality Assurance
- 8.6.6 Sounding Mode
- 8.6.7 Profiling Mode

## Field Sampling Procedures Manual Table of Contents – Page 16 of 21

- 8.6.8 Profiling-Sounding Mode
- 8.6.9 Data Reduction and Interpretation
- 8.6.10 Presentation of Results

#### 8.7 Electromagnetics

- 8.7.1 Fundamentals
- 8.7.2 Advantages
- 8.7.3 Limitations
- 8.7.4 Instrumentation
- 8.7.5 Survey Design, Procedure and Quality Assurance
- 8.7.6 Data Reduction and Interpretation
- 8.7.7 Presentation of Results

## 8.8 Very-low Frequency (VLF) Electromagnetics

- 8.8.1 Fundamentals
- 8.8.2 Advantages
- 8.8.3 Limitations
- 8.8.4 Instrumentation
- 8.8.5 Survey Design, Procedure and Quality Assurance
- 8.8.6 Data Reduction and Interpretation
- 8.8.7 Presentation of Results

#### 8.9 Seismic

- 8.9.1 Fundamentals
- 8.9.2 Instrumentation
- 8.9.3 The Seismic Refraction Method

Figure 8.2 Seismic Refraction

- 8.9.3.1 Seismic Refraction Advantages
- 8.9.3.2 Seismic Refraction Limitations
- 8.9.3.3 Seismic Refraction Survey Design, Procedure and Quality Assurance Figure 8.3 Observer's Log
- 8.9.3.4 Seismic Refraction Data Reduction and Interpretation
- 8.9.3.5 Seismic Refraction Presentation of Results
- 8.9.4 The Seismic Reflection Method

Figure 8.4 Seismic Reflection

- 8.9.4.1 Seismic Reflection Advantages
- 8.9.4.2 Seismic Reflection Limitations
- 8.9.4.3 Seismic Reflection Survey Design, Procedure, And Quality Assurance
- 8.9.4.4 Seismic Reflection Data Reduction and Interpretation
- 8.9.4.5 Seismic Reflection Presentation of Results

#### 8.10 Borehole Geophysical Methods

- 8.10.1 Introduction
- 8.10.2 Advantages
- 8.10.3 Limitations
- 8.10.4 Types of Borehole Tools
  - 8.10.4.1 Gamma Ray and Self Potential (SP) Devices
  - 8.10.4.2 Electrical Resistivity and Induction Devices
    - Figure 8.5 Lateral Resisitivity Sonde
    - Figure 8.6 Normal Resisitivity Sonde
    - Figure 8.7 High Frequency Electromagnetic Energy
  - 8.10.4.3 Porosity/Density Devices
    - Figure 8.8 Basic Sonic System

- 8.10.4.4 Mechanical Devices
- 8.10.4.5 Acoustic, Radar and Optical Devices

Figure 8.9 Magnetically oriented, acoustic-amplitude image of borehole wall generated from an acoustic televiewer.

Figure 8.10 "Virtual core" wrapped (left) and unwrapped (right) images of a bedrock fracture at a depth of 29.4 meters collected with a digital television camera.

- 8.10.5 Quality Assurance
- 8.10.6 Presentation of Results

#### References

## **URLs for Surface and Borehole Geophysical Methods**

## Chapter 9 – Soil Gas Surveys

- 9.1 Introduction
- 9.2 Theory
- 9.3 Soil Gas Generation and Movement
  - 9.3.1 Biological Decomposition
  - 9.3.2 Chemical Decomposition
  - 9.3.3 Physical Decomposition
  - 9.3.4 Transport Mechanisms
    - 9.3.4.1 Molecular Effusion
    - 9.3.4.2 Molecular Diffusion
    - 9.3.4.3 Convection

#### 9.4 Site Specific Characteristics

- 9.4.1 Chemical and Physical Properties of the Contaminant
  - 9.4.1.1 Concentration
    - Table 9.1 Compounds Found in Municipal Solid Waste Landfills

Table 9.2 Trace Compounds Found in Municipal Solid Waste Landfills

9.4.1.2 Partitioning

Figure 9.1 Phase Relationships for VOCs

- 9.4.1.3 Vapor Pressure
- 9.4.1.4 Microbial Degradation

Figure 9.2 Transformations of Chlorinated Aliphatic Hydrocarbons

- 9.4.2 Geologic Factors
  - 9.4.2.1 Soil Permeability
  - 9.4.2.2 Thickness of the Unsaturated Zone
  - 9.4.2.3 Barriers and Conductive Zones
    - Figure 9.3A Homogenous Soils in the Vadose Zone
    - Figure 9.3B Impermeable Clay Subsurface Layer
    - Figure 9.3C Impermeable Surface Layer
    - Figure 9.3D Zone of High Microbial Activity
    - Figure 9.3E Source of VOCs in the Vadose Zone
- 9.4.3 Hydrologic and Hydrogeologic Properties
  - 9.4.3.1 Water Table Oscillations
  - 9.4.3.2 Background Water Quality
  - 9.4.3.3 Rainfall, Barometric Pressure and Wind

#### 9.5 Investigation Sampling Designs

9.5.1 Grids

Figure 9.4 Site Monitoring Network Grid Sampling

## Field Sampling Procedures Manual Table of Contents – Page 18 of 21

0	5	2	Transect	Т	inac
9	`	- 7.	Transect		ines

Figure 9.5 Site Monitoring Network Transect Lines

- 9.5.3 Biased
- 9.5.4 Random
- 9.5.5 Combined
- 9.5.6 Vertical Profiling
- 9.5.7 Sample Spacing
- 9.5.8 Sampling Frequency

## 9.6 Health And Safety

- 9.6.1 Underground Utilities
- 9.6.2 License Requirements

Table 9.3 License Requirement

## 9.7 Active Sample Collection Methodologies

- 9.7.1 Ground Probes
  - Figure 9.6 Passive Placed Probe
  - Figure 9.7 Drive Ground Probe
  - Figure 9.8 Ground Probes Ambient Air Short Circuiting
- 9.7.2 Permanent Soil Gas Probes
  - Figure 9.9 Soil Gas Sampling Probes
  - Figure 9.10 Soil Gas Well Schematic
  - Figure 9.11 Ball Valve for Soil Gas Well
  - Figure 9.12 Comparison of Multi-Depth Soil Gas Well Designs
- 9.7.3 Materials of Construction
- 9.7.4 Purge Rates and Volume
  - Table 9-4. Purge Volumes for Select Tubing Sizes
  - Figure 9.13A Purge pump with flow control and vacuum guage
  - Figure 9.13B Purge pump with DRI inline
  - Figure 9.13C Purge pump with syringe adapter
- 9.7.5 Short Circuiting
- 9.7.6 Pressure Measurements

Figure 9.14 Soil Gas Pressure vs. Barometric Pressure

## 9.8 Passive Sample Collection Methodologies

9.8.1 Sorbents

Figure 9.15 Passive sorbent sampler

- 9.8.1.1 Gore-Sorber® Passive Sampler
- 9.8.1.2 Quadrel Emflux® Soil Gas Sampler
- 9.8.1.3 Sample Depths
- 9.8.1.4 Sample Spacing
- 9.8.1.5 Sample Exposure Time
- 9.8.1.6 Multiple Surveys
- 9.8.1.7 Data Interpretation
- 9.8.2 The Emission Isolation Flux Chamber

Figure 9.16 Surface flux chamber

## 9.9 Soil Gas Sample Containers

Figure 9.17 Air sampling equipment

- 9.9.1 Gas Sample Bags
- 9.9.2 Glass Bulbs
- 9.9.3 Syringes

- 9.9.4 Stainless Steel Canisters
- 9.9.5 Sorbents

## 9.10 Analytical Methodologies

- 9.10.1 Detector Tubes
- 9.10.2 Direct Reading Instruments (DRI)
- 9.10.3 Portable Gas Chromatographs (G.C.)
- 9.10.4 GC/Mass Spectroscopy (GC/MS)

## 9.11 Quality Assurance/Quality Control

- 9.11.1 Adhere to Sampling Procedures
- 9.11.2 Equipment Blanks
- 9.11.3 Trip Blanks
- 9.11.4 Background Measurements
- 9.11.5 Duplicates
- 9.11.6 Decontamination
- 9.11.7 Leak Checks
- 9.11.8 Equipment Calibration
- 9.11.9 Limitations of the Analytical Methodology

## 9.12 Soil Gas Data Interpretation

## 9.13 Data Reporting

**Soil Gas Probe Monitoring Record** 

References

## **Chapter 10 – Documentation**

- 10.1 Introduction
- 10.2 Field Log Books
- 10.3 Documenting Sampling Points
- 10.4 Photo-Documentation

#### 10.5 Sample Collection Paperwork

- 10.5.1 Sample Labels
- 10.5.2 Chain of Custody/Sample Analysis Request
  - 10.5.2.1 External Chain of Custody and Sample Analysis Request Form WITH shipping con tainer.
  - 10.5.2.2 External Chain of Custody and Sampling Analysis Request Form WITHOUT shipping container.

New Jersey Department of Environmental Protection External Chain of Custody and Sample Analysis Request Form (With Shipping Container)

New Jersey Department of Environmental Protection External Chain of Custody and Sampling Analysis Request Form (Without Shipping Container)

## **Chapter 11 – Sample Shipment**

- 11.1 Introduction
- 11.2 Definitions
- 11.3 Training
- 11.4 Shipper's Responsibility
- 11.5 Hazard Classes
- 11.6 Packing

## Field Sampling Procedures Manual Table of Contents – Page 20 of 21

#### 11.7 Marking and Labeling

#### 11.8 Documentation

## 11.9 Preservation of Samples Relative to Dangerous Goods Shipment

Table 11.1 Hazard Classes and Applicable Regulations

#### References

## Chapter 12 - Radiological Assessment

#### 12.1 Introduction

Figure 12.1 Comparison of MARSSIM and the Technical Requirements

## 12.2 The Planning Stage (Data Life Cycle)

#### 12.3 Site Identification/Historical Site Assessment

## 12.4 The Scoping Survey

- 12.4.1 Identify Contaminants
- 12.4.2 Establish the Derived Concentration Guideline Levels (DCGLs)
- 12.4.3 Classify the Area by Contamination Potential
- 12.4.4 Determine Background
- 12.4.5 Perform the Survey
- 12.4.6 Document the Scoping Survey Results

## 12.5 The Characterization Survey

- 12.5.1 Determination of Lateral and Vertical Extent of Contamination
- 12.5.2 Determine Background
- 12.5.3 Classify the Area by Contamination Potential
- 12.5.4 Document the Characterization Survey Results

#### 12.6 The Remedial Action Support Survey

## 12.7 The Final Status Survey

- 12.7.1 Revisit the Area Classifications
- 12.7.2 Determine the Relative Shift
- 12.7.3 Determination of Acceptable Type I and Type II Decision Errors
- 12.7.4 Determine the Number of Samples Needed
- 12.7.5 Additional Samples for Elevated Measurement Comparison in Class 1 Areas Table 12.1 Outdoor Area Dose Factors
- 12.7.6 Determining Sample Locations
- 12.7.7 Investigation Levels and Scanning Coverage Fractions Table 12.2 Final Status Survey Investigation Levels
- 12.7.8 Special Survey Considerations Subsurface Residual Radioactivity
- 12.7.9 Determining Compliance
- 12.7.10 Mixing After Demonstrating Compliance with the Pre-mixing DCGLs
- 12.7.11 Documenting the Final Status Survey

#### References

**Acronyms** 

**Glossary** 

**Endnotes** 

### **Chapter 13 – Personnel Protection**

#### 13.1 Introduction

## 13.2 Selection of Respiratory Equipment

- 13.2.1 Self-Contained Breathing Apparatus (SCBA)
- 13.2.2 Supplied-Air Respirators (SARs)
- 13.2.3 Combination SCBA/SAR
- 13.2.4 Air-Purifying Respirators

## 13.3 Selection of Protective Clothing and Accessories

- 13.3.1 Selection of Chemical-Protective Clothing (CPC)
- 13.3.2 Other Considerations
- 13.3.3 Special Conditions

#### 13.4 Selection of Ensembles/Level of Protection

- Table 13.1 Sample Protective Ensembles Level of Protection A
- Table 13.1 Sample Protective Ensembles Level of Protection B
- Table 13.1 Sample Protective Ensembles Level of Protection C
- Table 13.1 Sample Protective Ensembles Level of Protection D

#### 13.5 PPE Use

- 13.5.1 Training
- 13.5.2 Work Mission Duration
- 13.5.3 Personal Use Factors
- 13.5.4 Donning an Ensemble
- 13.5.5 Respirator Fit Testing
- 13.5.6 Doffing an Ensemble
- 13.5.7 Inspection
- 13.5.8 Storage

## 13.6 Heat Stress and Other Physiological Factors

- 13.6.1 Monitoring
- 13.6.2 Prevention

Table 13.2 Signs and Symptoms of Heat Stress

- 13.6.3 Other Factors
  - 13.6.3.1 Physical Condition
  - 13.6.3.2 Level of Acclimatization
  - 13.6.3.3 Age
  - 13.6.3.4 Weight

#### References

## **Chapter 14 – Personnel Contamination Reduction**

#### 14.1 Introduction

#### 14.2 Steps In Doffing Disposable PPE

## 14.3 Doffing Reusable PPE

- Figure 14.1 Maximum Decontamination Layout Level A Protection
- Figure 14.2 Maximum Decontamination Layout Level B Protection
- Figure 14.3 Maximum Decontamination Layout Level C Protection
- Figure 14.4 Minimum Decontamination Layout Levels A & B Protection
- Figure 14.5 Minimum Decontamination Layout Level C Protection

#### 14.4 Low Level Contamination

#### References

#### **Glossary of Technical Terms**